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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/796,577	03/08/2004	Anne L. Testoni	KLA1P107	1102
22434	7590	11/23/2005	EXAMINER	
BEYER WEAVER & THOMAS LLP			QUASH, ANTHONY G	
P.O. BOX 70250			ART UNIT	
OAKLAND, CA 94612-0250			PAPER NUMBER	
			2881	

DATE MAILED: 11/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No. **10796,577**

Applicant(s)

TESTONI, ANNE L.

Examiner

Anthony Quash

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-53 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-53 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 March 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 3/8/04.

- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: 503. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

Claim 16 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 16 recites the limitation "detectors" in line 1 of the claim. There is insufficient antecedent basis for this limitation in the claim. It is believed the applicant meant to say "detector". Appropriate correction is required.

Claim Rejections - 35 USC § 102

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 15,17,32 are rejected under 35 U.S.C. 102(e) as being anticipated by Nasser-Ghodsi [6,810,105]. As per claim 15, Nasser-Ghodsi [6,810,105] discloses a method of inspecting a defect in or on a semiconductor wafer, comprising directing a beam towards the surface of the semiconductor wafer wherein/whereon the defect resides to thereby emit x-rays, detecting the emitted x-rays with a detector a first angle with respect to the wafer surface, collecting x-ray data from the detector, directing a beam towards the surface of the semiconductor wafer wherein/whereon the defect resides to thereby emit x-rays, detecting the emitted x-rays with the detector at second angle with respect to the wafer surface, collecting x-rays with the detector at a second angle with respect to the wafer surface, collecting x-ray data from the detector and using the x-ray data to spatially resolve the location of the defect with respect to the semiconductor wafer. See Nasser-Ghodsi [6,810,105] abstract, figs. 1-3,5-8, col. 1 lines 25-60, **col. 2 lines 25-45,55-63**, col. 3 lines 25-65, col. 4 lines 8-67, col. 5 lines 5-30, 40-67, col. 6 lines 5-25, col. 7 lines 5-40, col. 8 lines 4-5,35-55, col. 9 lines 8-15,45-65, and **col. 10 lines 30-45**.

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As per claim 17, Nasser-Ghodsi [6,810,105] discloses the detector detects emitted x-rays at a plurality of angles with respect to the wafer surface. See Nasser-Ghodsi [6,810,105] col. 2 lines 25-62, col. 10 lines 30-67.

As per claim 32, Nasser-Ghodsi [6,810,105] discloses a method of inspecting a defect in or on a semiconductor wafer, comprising directing a beam towards the surface of the semiconductor wafer wherein/whereon the defect resides to thereby emit x-rays, detecting the emitted x-rays at a plurality of angles with respect to the wafer surface with one detector, collecting x-ray data from the detector, and using the x-ray data to spatially resolve the location of the defect with respect to the semiconductor wafer. See Nasser-Ghodsi [6,810,105] abstract, figs. 1-3, 5-8, col. 1 lines 25-60, **col. 2 lines 25-45, 55-63**, col. 3 lines 25-65, **col. 4 lines 8-28, 39-67**, col. 5 lines 5-30, 40-67, col. 6 lines 5-25, **col. 7 lines 5-40**, col. 8 lines 4-5, 35-55, col. 9 lines 8-15, 45-65, and **col. 10 lines 30-45**.

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1,9-14,18-19, 26-31,41-46, are rejected under 35 U.S.C. 103(a) as being obvious over Nasser-Ghodsi [6,810,105]. As per claim 1, Nasser-Ghodsi [6,810,105] teaches a method of inspecting a defect in or on a semiconductor wafer comprising directing a beam towards the surface the semiconductor wafer wherein/whereon the defect resides to thereby emit x-rays, detecting the emitted x-rays with plurality of detectors (col. 7 lines 5-7), collecting x-ray data from the detectors and using the x-ray data to spatially resolve the location of the defect with respect to the semiconductor wafer. See Nasser-Ghodsi [6,810,105] abstract, figs. 1-3,5-8, col. 1 lines 25-60, col. 2 lines 25-45,55-63, col. 3 lines 25-65, col. 4 lines 8-67, col. 5 lines 5-30, 40-67, col. 6 lines 5-25, col. 7 lines 5-40, col. 8 lines 4-5,35-55, col. 9 lines 8-15,45-65, and col. 10 lines 30-45. However, Nasser-Ghodsi [6,810,105] does not explicitly state the plurality of detectors being located a plurality of angles. Nasser-Ghodsi [6,810,105] does teach that is advantageous to detect x-rays from different angles. See Nasser-Ghodsi [6,810,105] col. 4 lines 45-60, col. 10 lines 30-45. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to have the plurality of detectors be located at a plurality of angles in order to obtain a

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more thorough characterization of dishing and erosion (defect), and a surface topography as taught in Nasser-Ghodsi [6,810,105].

As per claims 9,26,41, Nasser-Ghodsi [6,810,105] teaches the directed beam being an electron beam (col. 4 lines 20-25, 45-50).

As per claims 10,27,42, Nasser-Ghodsi [6,810,105] teaches all aspects of the claim except for explicitly stating the directed beam being a focused ion beam. However, Nasser-Ghodsi [6,810,105] does explicitly states, "Any apparatus that is capable of causing a test sample to emit x-rays is referred to herein as an x-ray inducer." See Nasser-Ghodsi [6,810,105] col. 4 lines 18-23. The examiner interprets this as indicating that a focused ion beam can be the x-ray inducer, thereby satisfying applicant's claim.

As per claims 11,28,43, Nasser-Ghodsi [6,810,105] teaches the elemental composition can be determined from the x-ray data. See Nasser-Ghodsi [6,810,105] abstract, figs. 1-3,5-8, col. 1 lines 25-60, col. 2 lines 25-45,55-63, col. 3 lines 25-65, col. 4 lines 8-67, col. 5 lines 5-30, 40-67, col. 6 lines 5-25, col. 7 lines 5-40, col. 8 lines 4-5,35-55, col. 9 lines 8-15,45-65, and col. 10 lines 30-45.

As per claim 12,29,44, Nasser-Ghodsi [6,810,105] teaches the semiconductor wafer comprises copper surrounded by dielectric material. See Nasser-Ghodsi [6,810,105] fig. 3, col. 5 lines 35-51.

As per claims 13,30,45, Nasser-Ghodsi [6,810,105] teaches the detected x-rays being at least copper K α and copper L α x-rays. See Nasser-Ghodsi [6,810,105] col. 6 lines 10-23, col. 7 lines 30-40, and col. 9 lines 45-60.

As per claims 14,31,46 Nasser-Ghodsi [6,810,105] teaches all aspects of the claim except for explicitly stating that the material exposed to the electron beam comprise silicon. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the material exposed to the electron beam comprise silicon, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In addition, this material would then give off silicon K α .

As per claim 18, Nasser-Ghodsi [6,810,105] discloses all aspects of the claim except for explicitly stating that the second angle of the detector with respect to the wafer surface is achieved by moving the position of the detector after collecting the x-ray data from the first angle. Nasser-Ghodsi [6,810,105] does infer this. This is made evident when Nasser-Ghodsi [6,810,105] states, "The method includes identifying a first measurement of induced x-ray emissions characteristic of a first material at a first scan target resulting from the first scan from a first direction, identifying a second measurement of induced x-ray emissions characteristic of the first material at the first scan target resulting from a second scan from a second direction, and providing the first and second measurements to allow characterization of dishing and/or erosion associated with the first scan target in the sample." (Nasser-Ghodsi [6,810,105] col. 2 lines 54-62.) "In one example, the stage lies on the x-y plane and the stage is tilted by varying the angle α 161. It should be noted that tilting the sample relative to the inducer 120 can involve tilting the stage, moving the column, or deflecting the beam with a lens."

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(Nasser-Ghodsi [6,810,105] col. 4 lines 39-43.) Also see Nasser-Ghodsi [6,810,105] abstract, figs. 1-3,5-8, col. 1 lines 25-60, col. 2 lines 25-45,55-63, col. 3 lines 25-65, col. 4 lines 8-67, col. 5 lines 5-30, 40-67, col. 6 lines 5-25, col. 7 lines 5-40, col. 8 lines 4-5,35-55, col. 9 lines 8-15,45-65, and col. 10 lines 30-45. Therefore it is the examiner's view that Nasser-Ghodsi [6,810,105] has implied that the second angle of the detector with respect to the wafer surface is achieved by moving the position of the detector after collecting the x-ray data from the first angle.

As per claim 19, Nasser-Ghodsi [6,810,105] teaches the first angle of the detector with respect to the wafer being achieved by tilting the wafer after collecting the x-ray data from the first angle. See Nasser-Ghodsi [6,810,105] abstract, figs. 1-3,5-8, col. 1 lines 25-60, col. 2 lines 25-45,55-63, col. 3 lines 25-65, col. 4 lines 8-67, col. 5 lines 5-30, 40-67, col. 6 lines 5-25, col. 7 lines 5-40, col. 8 lines 4-5,35-55, col. 9 lines 8-15,45-65, and col. 10 lines 30-45.

Claims 2-8,20-25,33-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nasser-Ghodsi [6,810,105] in view of Albert [5,237,598]. With respect to claims 2-8,22-25, 33-40,51-52, Nasser-Ghodsi [6,810,105] teaches all aspects of the claim except for explicitly stating that the detectors detect the emitted x-rays simultaneously. Albert [5,237,598] teaches that it was known to have the detectors detect the emitted x-rays simultaneously. See Albert [5,237,598] col. 12 lines 43-60. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to have the detectors detect the emitted x-rays simultaneously to provide a real-time of image of the defect. In addition, Albert

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[5,237,598] teaches using the x-ray data to spatially resolve the location of the defect by generating an image based on the x-ray data, the defect residing fully within the sample volume, and beam being raster scanned over an area where the defect resides. See Albert [5,237,598]. See Albert [5,237,598] abstract, figs. 1,15, col. 2 lines 15-35,40-45,58-68, col. 5 lines 1-5,20-30, col. 9 lines 1-5, col. 10 lines 40-55, col. 12 lines 19-20,42-60, col. 13 lines 30-45, col. 14 lines 40-50.

Claims 47-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagatsuka [4,885,465] in view of Nasser-Ghodsi [6,810,105]. As per claim 47, Nagatsuka [4,885,465] teaches a beam generator (1) to direct a charged particle beam towards a structure, a plurality of detectors (8,13) to detect x-rays from the structure in response to the charged particle beam, and a processor (11) operable to cause the beam generator to direct the beam towards the structure, and characterize one or more defects based on the detected x-rays. See Nagatsuka [4,885,465] abstract, figs. 1-2, **col. 1** lines 5-15, **20-25**,50-62, col. 2 lines 5-10,40-55, and col. 3 line 60-col. 4 line 20. However, Nagatsuka [4,885,465] does not explicitly state the plurality of detectors being positioned at different angles. Nasser-Ghodsi [6,810,105] does teach that is advantageous to detect x-rays from different angles. See Nasser-Ghodsi [6,810,105] col. 4 lines 45-60, col. 10 lines 30-45. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to have the plurality of detectors be located at a plurality of angles in order to obtain a more thorough characterization of dishing and erosion (defect), and a surface topography as taught in Nasser-Ghodsi [6,810,105].

As per claim 48, Nagatsuka [4,885,465] teaches the characterizing operation being based on a ratio of a first x-ray intensity for a first material over a second x-ray intensity for a second material, wherein the first and second x-ray intensities are obtained from the detected x-rays from the scanned structure. See Nagatsuka [4,885,465] abstract, figs. 1-2, **col. 1** lines 5-15, **20-25**, 50-62, **col. 2** lines 5-10, 40-55, and **col. 3** line 60-**col. 4** line 20.

As per claim 49, Nasser-Ghodsi [6,810,105] teaches the scanned structure being a portion of an interconnect structure in an integrated circuit device. See Nasser-Ghodsi [6,810,105] **col. 1** lines 25-31, **col. 3** lines 25-32, **col. 10** lines 30-50.

As per claim 50, Nasser-Ghodsi [6,810,105] teaches the directed beam being an electron beam (**col. 4** lines 20-25, 45-50).

As per claim 51, Nasser-Ghodsi [6,810,105] teaches the electron beam being stepped over an area of the sample surface. See Nasser-Ghodsi [6,810,105] **col. 4** lines 5-16.

As per claim 52, Nasser-Ghodsi [6,810,105] teaches the electron beam being rastered over an area of the sample surface. See Nasser-Ghodsi [6,810,105] **col. 4** lines 65-**col. 5** line 3.

As per claim 53, Nasser-Ghodsi [6,810,105] teaches all aspects of the claim except for explicitly stating the directed beam being a focused ion beam. However, Nasser-Ghodsi [6,810,105] does explicitly state, "Any apparatus that is capable of causing a test sample to emit x-rays is referred to herein as an x-ray inducer." See Nasser-Ghodsi [6,810,105] **col. 4** lines 18-23. The examiner interprets this as

indicating that a focused ion beam can be the x-ray inducer, thereby satisfying applicant's claim.

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(I)(1) and § 706.02(I)(2).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patent Nos. 5,703,361 to Sartore, 5,594,246 to Sudo et al, 5,866,903 to Morita et al, 6,664,541 to Nasser-Ghodsi et al, 5,877,498 to Sugimoto et al, and 6,924,484 to Wang et al, are considered pertinent to the applicant's disclosure.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anthony Quash whose telephone number is (571)-272-2480. The examiner can normally be reached on Monday thru Friday 9 a.m. to 5 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R. Lee can be reached on (571)-272-2477. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A. Quash
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11/18/05

Nikita Wells
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PRIMARY EXAMINER

11/19/05